# Understanding primary care nurses' contribution to cancer early diagnosis: A systematic review

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## ARTICLE INFO

## ABSTRACT

*Purpose:* Primary care nurses can contribute to cancer early diagnosis. The objective of this systematic review was to identify, appraise and synthesise evidence on primary care nurses' contribution towards cancer early diagnosis in developed countries.

*Method:* The following databases were searched in September 2017: MEDLINE, PsychINFO, CINAHL, SCOPUS, and EMBASE. Data were extracted on nurses': knowledge of cancer; frequency of 'cancer early diagnosis-related discussions' with patients; and perceived factors influencing these discussions. Studies were appraised using the Mixed Methods Appraisal Tool.

*Results:* Twenty-one studies were included from: United States, United Kingdom, Ireland, Spain, Turkey, Australia, Brazil and Middle East. Studies were mostly of low quality (one did not meet any appraisal criteria, 15 met one, four met two, and one met three). Nurses' knowledge of cancer, and their frequency of 'cancer early diagnosis-related discussions', varied across countries. This may be due to measurement bias or nurses' divergent roles across healthcare systems. Commonly perceived barriers to having screening discussions included: lack of time, insufficient knowledge and communication skills, and believing that patients react negatively to this topic being raised.

*Conclusions:* Findings suggest a need for nurses to be adequately informed about, and have the confidence and skills to discuss, the topic of cancer early diagnosis. Further high-quality research is required to understand international variation in primary care nurses' contribution to this field, and to develop and evaluate optimal methods for preparing them for, and supporting them in, this.

## 1. Introduction

Cancer is the second leading cause of death worldwide (World Health Organization, 2018a). Estimates suggest it represents one in six deaths globally - there were 8.8 million cancer-related deaths reported in 2015 (World Health Organization, 2018b). Early diagnosis is heralded as key to improving chances of effective cancer treatment and survival (Neal et al., 2015; World Health Organization, 2017). Reducing time between disease onset and diagnosis has become a global priority (Rubin et al., 2011; Walter et al., 2012).

In developed countries, primary care professionals are commonly the first point of contact for patients. They have an important role in recognising and responding to cancer warning signs (Brown et al., 2014; Emery, 2015; Rubin et al., 2015). Furthermore, they have opportunity to encourage both prompt help-seeking and participation in cancer screening (Weller and Campbell, 2009).

Within developed countries, primary care has traditionally been

provided by physicians (Norful et al., 2017). However, a progressively growing and aging patient population has led to increased demands on primary care providers; this pressure has been eased by expanding nursing roles (McCarthy et al., 2012; Merrick et al., 2012; Procter et al., 2017). Primary care nurses have taken on responsibility for managing chronic diseases, triaging acute minor conditions, and screening for cancer (Norful et al., 2017). Although their specific roles and duties vary across healthcare systems, primary care nurses have the opportunity to contribute to cancer early diagnosis. Due to their expanding role, primary care nurses are increasingly likely to encounter patients with cancer warning signs, and make decisions about appropriate response (e.g. referral to primary care colleagues or specialist care, or advising patients to return if symptoms persist). They are also ideally placed to have conversations with patients about cancer warning signs and benefits of prompt help-seeking (Walter et al., 2012).

Health promotion, and holistic care, are integral to nursing roles (Bradby and McCallum, 2015; Halcomb et al., 2006; McCarthy et al.,

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2012; Seale et al., 2006). Evidence suggests patients feel more at ease during consultations with nurses, than physicians (Cromme et al., 2016). It would be logical to suggest that patients may feel more comfortable discussing concerns about potential cancer symptoms with this professional group.

Primary care nurses can also promote informed decision-making about participation in cancer screening (Weller and Campbell, 2009). Several developed countries offer screening for breast, cervical and colorectal cancer (Dowling et al., 2010; Klabunde et al., 2015). However, for benefits of screening to be realised, a substantial proportion of the population must take part (Weller and Campbell, 2009). Evidence suggests screening uptake is improved when primary care professionals recommend, or provide health education about, cancer screening (Calanzani et al., 2017; Rubin et al., 2015).

This review was undertaken to inform future research exploring the cancer early diagnosis role, and associated training needs, of primary care nurses in the United Kingdom (UK). A literature search determined that no systematic reviews in this field had been published. This review aimed to identify, appraise and synthesise evidence on primary care nurses' contribution towards cancer early diagnosis in developed countries. It set out to answer the following questions:

- Do primary care nurses contribute to cancer early diagnosis in developed countries?
- Does their contribution vary internationally?

The review was restricted to developed countries in the knowledge that healthcare systems, and roles of health professional groups, vary widely between developing and developed countries. We acknowledge that there are differences within healthcare systems across developed countries regarding primary care practices (e.g. opportunistic vs. organised screening programmes); these were taken into consideration when interpreting study findings. However, developed countries were considered to be sufficiently analogous regarding primary care workforces, availability of screening and diagnostic procedures, and other factors (e.g. life expectancy, and poverty and education levels) to allow comparison and synthesis of findings (Bray et al., 2012; Coleman et al., 2008).

## 2. Methods

The review followed PRISMA guidelines (Moher et al., 2009). The protocol was registered on PROSPERO (registration number: CRD42018083809).

### 2.1. Study eligibility

Eligible studies reported on:

- Qualified nurses who were either:
  - Registered nurses trained through either hospital or university-based education (e.g. Bachelor Degrees), providing care to patients with some degree of supervision from physicians;
  - Nurse practitioners recognised as advanced clinicians with additional experience and/or educational attainment (e.g. Masters Degrees), providing autonomous care alongside physicians (Halcomb et al., 2006; Hoare et al., 2012).
- Contributions of qualified nurses separately from other healthcare professionals in the sample (if multiple professional groups were studied).
- Qualified nurses working in settings where primary health care is provided. This included, but was not exclusive to, nurses working in family practice.
- Research conducted in countries deemed developed; defined for the purpose of this review as those ranked as 'very high' or 'high' on the 2018 Human Development Index (United Nationals Development

Programme, 2018). This index measures human development by comparing countries against three dimensions: a long and healthy life (i.e. life expectancy), access to knowledge (i.e. adult literacy and education level), and a decent standard of living (based on GDP per head adjusted for purchasing-power parity) (Bray et al., 2012).
- Research of diverse methodological designs (i.e. quantitative, qualitative and mixed-methods).

Only studies published in English-language in the past 20 years were included. This cut-off was chosen as primary care nurses' role has been expanding in recent decades; in the UK, nurse-led consultations started to increase from the late 1990s, due to quality improvement initiatives within primary care at this time (Hoare et al., 2012; Murrells et al., 2015).

Outcomes of interest included:

1. Nurses' knowledge of cancer warning signs, screening recommendations, diagnostic procedures, and referral guidelines.
2. Frequency of nurses' discussions with patients which aim to raise awareness of cancer warning signs, encourage prompt help-seeking, and provide information about screening (i.e. 'cancer early diagnosis-related discussions').
3. Factors perceived by nurses to influence 'cancer early diagnosis-related discussions' with patients.
4. Training and support perceived by nurses to improve their cancer knowledge, and 'cancer early diagnosis-related discussions' with patients.

Studies were excluded if they focused exclusively on:

- Nurses' knowledge of, or discussions about, self-examination techniques (e.g. breast or testicular self-examination) which aim to detect possible abnormalities; this is because regular use of these techniques is no longer recommended in several developed countries (Graham, 2004; McCready et al., 2005).
- Nurses' knowledge of, or discussions about, screening procedures not currently offered as part of organised programmes in the UK (e.g. prostate-specific antigen testing).
- Outcomes of interest for aspects of the cancer pathway other than help-seeking, screening and diagnosis (e.g. risk assessment, treatment, survivorship, or end-of-life care).

### 2.2. Search strategy

The following databases were searched in September 2017: MEDLINE, PsychINFO, CINAHL, SCOPUS, and EMBASE. Search terms comprised four facets: cancer, early diagnosis, nurses, and primary care. Strategies for each database are provided as Supplementary Material. Reference lists of all eligible articles were also hand searched. Grey literature was not searched.

### 2.3. Study selection

Electronic searches identified 2678 studies; 1680 studies remained after duplicates were removed (Fig. 1). These were appraised independently by two researchers [HS & KP]. Any disagreements regarding the inclusion of a study were resolved through discussions. A third researcher [ER] was at hand to arbitrate if required. However, this was not needed as disagreements were always resolved following discussions between the two researchers.

Title screening led to 1529 exclusions - a further 96 studies were excluded on reading abstracts and 35 on reading full texts. Thus, 20 were eligible for inclusion. Searching of these studies' reference lists identified one additional eligible study.

The included 21 studies comprised of: 18 quantitative, two qualitative and one mixed-method study. However, the qualitative
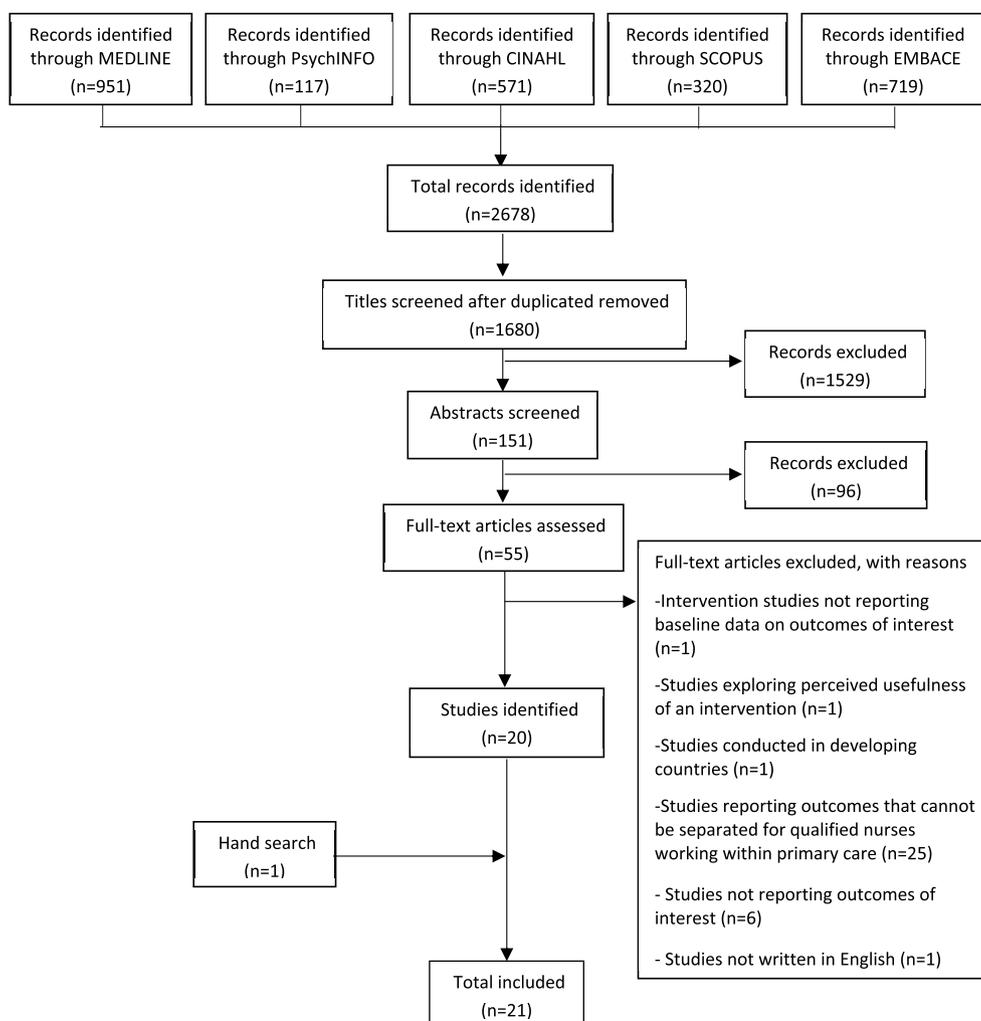
**Fig. 1.** PRISMA diagram of search results.

component of the mixed-method study did not report specifically on outcomes relating to nurses' role in cancer early diagnosis, only to their role in the general prevention and diagnosis of cancer. Thus, only findings from the quantitative component are reported in this review.

### 2.4. Data extraction

A data extraction tool was developed for the study (see Supplementary Material); this was adapted from a tool previously developed and used by ER (Cox et al., 2017). Extracted information included: study aims, design, methods, healthcare system factors, participant demographics, results, and key conclusions.

Data was initially extracted by HS. Another researcher [KW] extracted data from 20% of studies (n = 5), to check consistency. Any disagreements were to be resolved through discussion between the two researchers; ER was to arbitrate if needed. However, this was not required as there was no disagreement in data extraction.

Data extracted from the quantitative studies included numerical values on outcomes of interest, which were extracted from tables/figures and text. For qualitative studies, data was extracted following recommendations by Thomas and Harden (2008), which involved extracting entire 'results' sections of articles, including verbatim quotes.

For all studies measuring knowledge of warning signs, findings were only extracted for specific symptoms that are included in versions of the Cancer Awareness Measure (CAM; i.e. general awareness measure for all cancer types, and those specific to colorectal, breast, cervical and ovarian cancer). All versions of the CAM tool have been tested for reliability and validity (Linsell et al., 2010; Low et al., 2012, 2013; Power et al., 2011; Stubbings et al., 2009). By including findings only on symptoms measured by the CAM, it ensured that knowledge was assessed only for known warning signs.

### 2.5. Quality appraisal

The Mixed Methods Appraisal Tool (MMAT) was used to assess methodological rigour of included studies (Pluye et al., 2011). The MMAT was selected for this review as it allows the use of one tool to concomitantly appraise studies with diverse methodological designs (Pluye, 2015). The MMAT has proven theoretical and content validity, and been tested for reliability (Pace et al., 2012; Pluye, 2015; Pluye et al., 2009; Souto et al., 2015). It has also been used in previous systematic reviews examining psychosocial issues relating to cancer (Puts et al., 2015; Renzi et al., 2015; Smith et al., 2015), including one review that also identified a limited number of qualitative studies for inclusion (Radisic et al., 2017).

The MMAT includes two screening items assessing the quality of objectives and extent to which they are addressed by the data. It includes four quality assessment items for both qualitative and descriptive quantitative studies; those specific to quantitative randomised controlled trials, and non-randomised studies, were removed from the tool since the included studies did not comprise such designs. Items are rated as 'yes', 'no' or 'can't tell', with one point awarded for each 'yes'

**Table 1**
Summary of study characteristics and main findings.

| Author (year) | Country | Sampling method | Design | Participants | MMAT score | Main findings |
|---|---|---|---|---|---|---|
| Blake & Malone (2014) | US | Regional -Convenience sample of Alumni (nurse practitioners) from Yale University's School of Nursing | Cross-sectional web-based self-administered survey | (n = 91/240), 38% response rate, 35% aged 41–50, 34% > 16 years practice experience | 1/4 | *Prevalence of training on skin cancer:* <br> - Construct measured by asking respondents to indicate agreement with a statement. <br> - 19% (n = 17) reported receiving training on skin cancer in the past year. |
| Boone et al. (2016) | US | Regional -Random sample of nurse practitioners derived from a commercial database of all active licensed practitioners within California | Cross-sectional postal self-administered survey | (n = 369/1451), 25% response rate | 1/4 | *Knowledge of cervical screening recommendations:* <br> - Construct measured using vignette-style survey items. <br> - 50% (n = 185) correctly identified '21 years' to be the recommended age of initiation. <br> - 67% (n = 247) correctly identified '65 years' to be the recommended age of termination. <br> - 43% (n = 159) correctly identified 'every three years' (for cytology testing alone), or 'every five years' (for co-HPV testing), to be the recommended time intervals for women aged 30 to 65. <br> - 33% (n = 122) correctly identified 'every three years' (for cytology testing alone) to be the recommended time interval for women aged 22 to 29. |
| Cooper et al. (2014) | US | Nationwide -Purposive sample of nurse practitioners, drawn from a panel of clinicians practicing across the US | Cross-sectional web-based self-administered survey | (n = 177/456), 39% response rate | 2/4 | *Knowledge of gynaecological cancer warning signs:* <br> - Construct measured by asking respondents to indicate possible warning signs, from a list. <br> - 42% (n = 75) correctly identified cervical cancer warning signs. <br> - 65% (n = 115) correctly identified ovarian cancer warnings signs. <br> - 72% (n = 127) correctly identified uterine cancer warning signs. <br> - 25% (n = 43) correctly identified vaginal cancer warning signs. <br> - 52% (n = 92) correctly identified vulva cancer warning signs. |
| De Moraes et al. (2016) | Brazil | Regional -Convenience sample of nurses working at 28 health centres in Ribeirão Preto | Cross-sectional structured face-to-face interview (location not specified) | (n = 60/96), 63% response rate, 37% < 10 years practice experience, 53% > 10 years practice experience | 1/4 | *Knowledge of breast screening recommendations:* <br> - Not adequately described how construct was measured. <br> - 5% (n = 3) correctly identified '50 years' to be the recommended age of initiation. <br> - 13% (n = 8) correctly identified 'every two years' to be the recommended time interval. |
| De Souza Teixeira et al. (2017) | Brazil | Regional -Convenience sample of nurses working at 17 health centres in Diadema | Cross-sectional structured face-to-face interview (conducted at health centre) | (n = 70/90), 77% response rate, 97% < 10 years practice experience, 3% > 10 years practice experience | 1/4 | *Frequency reporting to discuss breast screening with patients:* <br> - Not adequately described how construct was measured. <br> - 4% (n = 3) reported to recommend mammography to patients. |
| Ertem (2009) | Turkey | Regional -Convenience sample of nurses working at all health centres in Izmir | Cross-sectional self-administered survey (distribution method not reported) | (n = 97/114), 85% response rate, mean age = 33 (range = 20–40), 78% < 10 years practice experience, 22% > 10 years practice experience | 2/4 | *Knowledge of cervical cancer warning signs:* <br> - Construct measured by asking respondents to indicate possible warning signs, from a list. <br> - 77% (n = 75) correctly identified warning signs. <br> *Knowledge of cervical screening recommendations:* <br> - Construct measured by asking respondents to choose the correct answer to a statement, from a list. <br> - 36% (n = 35) correctly identified 'every two to three years' to be the recommended time interval. |

**Table 1** (*continued*)

| Author (year) | Country | Sampling method | Design | Participants | MMAT score | Main findings |
|---|---|---|---|---|---|---|
| Esteban-Vasallo et al. (2017) | Spain | Regional -Random sample of nurses working at 260 health centres in Madrid (stratified by health centres) | Cross-sectional web-based self-administered survey | (n = 636/unknown for nurses), Response rate not known, 18% aged < 40, 80% aged > 40 | 1/4 | *Prevalence of 'cancer early diagnosis-related' training:* <br> - Construct measured by asking respondents to indicate agreement with a statement. <br> - 8% (n = 52) reported receiving training on cancer early diagnosis during postgraduate education. |
| (Hallowell et al., 2017; Perin et al., 2015; Stormo et al., 2014) | Brazil | Nationwide -Convenience sample of nurses working at 1600 randomly selected health centres across Brazil | Cross-sectional telephone survey | (n = 347/533), 65% response rate, 53% aged ≤ 30, 38% aged 31–45, 8% aged 46–59, 3% aged ≥60, 85% female, 56% ≤ 5 years practice experience, 34% 6–15 years practice experience, 10% ≥ 15 years practice experience | 3/4 | *Knowledge of screening recommendations:* <br> - Construct measured by asking respondents to choose correct answers to statements, from a list. <br> - Among those reporting to conduct the screening procedures: <br> - 37% (n = 47/127) correctly initiated colorectal screening among individuals aged '50–55 years'. <br> - 14% (n = 47/329) correctly initiated cervical screening among women aged '25 years or older'. <br> - 11% (n = 35) correctly identified 'every two years' to be the recommended time interval for breast screening. |
| Lawvere et al. (2004) | US | Regional -Convenience sample of nurse practitioners working in western New York state | Cross-sectional postal self-administered survey | (n = 175/485), 36% response rate, 28% aged < 40, 72% aged > 40, 95% female | 1/4 | *Knowledge of breast screening recommendations:* <br> - Construct measured by asking respondents to choose correct answers to statements, from a list. <br> - 72% (n = 126) correctly identified '40 years' to be the recommended age of initiation. <br> - 72% (n = 126) correctly identified 'every one to two years' to be the recommended time interval for women aged 40–49. <br> - 50% (n = 88) correctly identified 'every year' to be the recommended time interval for women aged 50 or older. |
| McIlfatrick et al. (2014) | UK | Nationwide -Convenient sample of nurses, and nurse practitioners, working in general practices across Northern Ireland | Cross-sectional postal self-administered survey (quantitative component of mixed method study) | (n = 225/500), 45% response rate, 85% registered nurses, 15% nurse practitioners, 98% female | 1/4 | *Frequency reporting to discuss screening with patients:* <br> - Construct measured by asking respondents to indicate their agreement with statements. <br> - 92% (n = 197) reported routinely promoting cervical screening. <br> - 69% (n = 148) reported routinely promoting breast and colorectal screening. <br> - 87% (n = 221) reported routinely providing information on the benefits of cervical screening. <br> *Perceived barriers to having discussions about breast and colorectal screening* <br> - Not adequately specified how perceived barriers were measured. <br> - Among those who reported not discussing breast and colorectal screening with patients, commonly reported barriers included: lack of patient demand (% not reported), lack of staff support (% not reported) and lack of financial resources (% not reported) and lack of time (22.7%; n = 51). |
| McSherry et al. (2012) | Ireland | Nationwide -Convenience sample of nurses attending an Irish conference, and a random sample of nurses from six out of seven Irish administration areas (randomly selected by co-ordinators in each area) | Individual semi-structured interviews (telephone) | (n = 14/unknown), 100% female | 2/4 | *Factors perceived to influence having discussions about HPV and cervical screening:* <br> - Barriers commonly discussed included: perceived difficulty in initiating discussions and explain HPV in lay-terms; worry about causing embarrassment, or to appear judgemental; and concern that discussions |

**Table 1** (*continued*)

| Author (year) | Country | Sampling method | Design | Participants | MMAT score | Main findings |
|---|---|---|---|---|---|---|
| | | | | | | would make patients be prevented from attending cervical screening, or believe that their partner has been unfaithful.<br>- Facilitators frequently mentioned included: patients appearing open and interested; decision aids, leaflets, and guidelines being available on the topics; perceived ability to initiate discussions and clear plans on what to say. |
| Meng et al. (2007) | US | Regional -Random sample of nurse practitioners working in Florida | Cross-sectional postal self-administered survey | (n = 448/1357), 33% response rate, 15% aged < 40, 76% aged > 40, 88% female, 56% < 10 years practice experience, 39% > 10 years practice experience | 2/4 | *Perceived adequacy of training on oral cancer:*<br>- Construct measured by asking respondents to rate their perceived adequacy of training.<br>- 36% (n = 162) rated oral cancer training during NP education programme to be 'good/very good'. |
| Mills et al. (2012) | Australia | Regional -Purposive sample of nurses enrolled on a cervical screening provider course (in Queensland), who believe they have successfully implemented provision of cervical screening | Individual semi-structured interviews (location not specified) | (n = 18/unknown) | 1/4 | *Perceived adequacy of 'cancer early diagnosis-related' training and support:*<br>- Nurses perceived the availability and accessibility of physicians' advice to influence their knowledge.<br>- Peer networks were seen as providers of valuable support, and another opportunity to exchange knowledge or seek advice, beyond their initial training. |
| (Muliira et al., 2016a, 2016b) | Oman | Regional -Convenience sample of nurses working at 27 health centres in Muscat | Cross-sectional self-administered survey (distributed at health centre) | (n = 82/unknown for nurses), Response rate unknown | 1/4 | *Knowledge of colorectal screening recommendations:*<br>- Construct measured by asking respondents to choose correct answers to statements, from a list.<br>- 62% (n = 51) correctly identified '50 years' to be the recommended age of initiation.<br>- 40% (n = 33) correctly identified '75 years' to be the recommended age of termination.<br>- 37% (n = 30) correctly identified 'every year' to be the recommended time interval for Faecal Occult Blood testing.<br>- 34% (n = 28) correctly identified 'every five years' to be the recommended time interval for Flexible Sigmoidoscopy.<br>- 6% (n = 5) correctly identified 'every 10 years' to be the recommended time interval for Colonoscopy.<br>*Frequency reporting to discuss colorectal cancer and screening with patients:*<br>- Construct measured by asking respondents to indicate their agreement with statements.<br>- 9% (n = 7) reported recommending colorectal screening.<br>- 10% (n = 8) reported providing health education on colorectal cancer.<br>*Prevalence of 'cancer early diagnosis-related' training:*<br>- Construct measured by asking respondents to indicate agreement with a statement.<br>- 26% (n = 21) reported receiving training on cancer prevention and screening within the past three years. |

**Table 1** (*continued*)

| Author (year) | Country | Sampling method | Design | Participants | MMAT score | Main findings |
|---|---|---|---|---|---|---|
| | | | | | | *Perceived adequacy of 'cancer early diagnosis-related' training:*<br>- Construct measured by asking respondents to rate their perceived adequacy of training.<br>- 33% ($n = 27$) rated training on cancer prevention and screening to be 'adequate'. |
| Oliveira da Fonseca et al. (2016) | Brazil | Regional -Convenience sample of nurses working in Coronel Ezequiel and Espírito Santo | Cross-sectional face-to-face structured interview (location not specified) | ($n = 8$/unknown), Response rate unknown, 87% aged $< 40$, 13% aged $> 40$, 88% female, 100% $< 5$ years practice experience | 0/0 | *Knowledge of breast screening recommendations:*<br>- Not adequately described how knowledge was measured.<br>- 13% ($n = 1$) correctly identified '50 years' to be the recommended age of initiation. |
| Omran et al. (2015) | Jordan | Nationwide -Convenience sample of nurses working in health centres located in central, northern, and Southern Jordan | Cross-sectional web-based self-administered survey | ($n = 107$/unknown), Response rate unknown | 1/4 | *Knowledge of colorectal cancer warning signs:*<br>- Construct measured by asking respondents to recall four common symptoms of colorectal cancer.<br>- 25% ($n = 27$) correctly recalled the four warning signs.<br>*Knowledge of colorectal screening recommendations:*<br>- Not adequately described how knowledge was measured.<br>- 9% ($n = 21$)[a] correctly identified '50 years' to be the recommended age of initiation<br>- 5% ($n = 12$)[a] correctly identified '75 years' to be the recommended age of termination.<br>- 8% ($n = 18$)[a] correctly identified 'every year' to be the recommended time interval for Faecal Occult Blood testing.<br>- 3% ($n = 7$)[a] correctly identified 'every five years' to be the recommended time interval for Flexible Sigmoidoscopy.<br>- 1% ($n = 2$)[a] correctly identified 'every 10 years' to be the recommended time interval for Colonoscopy.<br>*Frequency reporting to discuss colorectal screening with patients:*<br>- Construct measured by asking respondents to indicate their agreement with statements.<br>- 2% ($n = 4$)[a] reported recommending colorectal screening.<br>- 4% ($n = 8$)[a] reported providing health education on colorectal cancer.<br>*Prevalence of 'cancer early diagnosis-related' training:*<br>- Construct measured by asking respondents to indicate agreement with statements.<br>- 8% ($n = 17$)[a] reported receiving training on general cancer prevention and screening within the past three years.<br>- 6% ($n = 2$)[a] reported receiving training on colorectal cancer prevention and screening within the past three years.<br>*Perceived adequacy of 'cancer early diagnosis-related' training:*<br>- Construct measured by asking respondents to rate their perceived adequacy of training. |

**Table 1** (*continued*)

| Author (year) | Country | Sampling method | Design | Participants | MMAT score | Main findings |
|---|---|---|---|---|---|---|
| Patel et al. (2016) | UK | Regional -Convenience sample of nurses working in the Leicester, Leicestershire and Rutland area | Cross-sectional web-based self-administered survey | (n = 94/479), 20% response rate, Age range: 27–61 (median: 50), 100% female | 1/4 | - 3% (n = 7)[a] rated training on cancer prevention and screening to be 'adequate/very adequate'. *Knowledge of cervical screening recommendations:* - Construct measured by asking respondents to choose the correct answer to a statement, from a list. - 93% (n = 87) correctly identified 'every three years' (if both cytology and HPV tests are negative following treatment of abnormal cells) to be the recommended time interval. *Prevalence of cervical screening training:* - Construct measured by asking respondents to indicate agreement with a statement. - 44% (n = 41) had received HPV-specific training within the past year. - 97% (n = 91) had ever received HPV-specific training. *Perceived adequacy of cervical screening training:* - Construct measured by asking respondents to provide comments about their training. - Suggestions were made about improving accessibility of training (e.g. through online training, and regular emails or newsletters with updates on the topic). |
| Ramos et al. (2010) | Spain | Regional -Convenience sample of nurses working at health centres located in the Balearic Islands | Cross-sectional self-administered survey (distributed at health centre) | (n = 592/1075), 55% response rate, | 1/4 | *Perceived barriers to having discussions about colorectal screening:* - Construct measured by asking respondents to indicate, from a list, those they perceived to be inhibitors. - Commonly endorsed barriers to personally encouraging reluctant patients to participate included: perceiving colonoscopy as invasive (66%; n = 390), false positives to generate anxiety (49%; n = 289), and patients being fed up with screening tests (33%; n = 192). - Frequently endorsed barriers to primary care professionals supporting the programme included: lack of time (84%; n = 497), professional burnout (54%; n = 320), lack of knowledge about screening (42%; n = 250) and colorectal cancer (35%; n = 207), involvement in other screening programmes (30%; n = 177), and difficulty explaining information in lay-terms (30%; n = 176). |
| Shaheen et al. (2000) | US | Regional -Convenience sample of nurse practitioners licenced in North Carolina (identified from medical board of state) | Cross-sectional postal self-administered survey | (n = 270/unknown for primary care nurse practitioners, Response rate unknown, Mean age: 45, 96% female, Mean years practice experience: 12.3 | 1/4 | *Frequency reporting to discuss colorectal screening with patients:* - Construct measured by asking respondents to indicate their agreement with statements. - 92% (n = 249) reported recommending Faecal Occult Blood testing. - 69% (n = 187) reported recommending Flexible Sigmoidoscopy. |
| Shimpi et al. (2016) | US | Regional -Convenience sample of nurse practitioners working at health centres in the western, central, and northern regions of Wisconsin (identified by health system database) | Cross-sectional web-based self-administered survey | (n = 10/unknown for nurse practitioners), Response rate unknown, 100% female | 1/4 | *Prevalence of oral cancer training:* - Construct measured by asking respondents to indicate agreement with a statement. - 10% (n = 1) reported receiving training on oral cancer at health-related school. |
| Yousuf et al. (2012) | Saudi Arabia | | | | 1/4 | *Knowledge of breast cancer warning signs and risk factors:* |

**Table 1** (*continued*)

| Author (year) | Country | Sampling method | Design | Participants | MMAT score | Main findings |
|---|---|---|---|---|---|---|
| | | Regional -Convenience sample of nurses working at health centres located in Jeddah | Cross-sectional postal self-administered survey | (n = 210/420), 50% response rate, 31% aged 22–31, 38% aged 32–41, 26% aged 42–51, 5% aged 52–59, 100% female, 36% < 10 years practice experience, 81% > 10 years practice experience | | - Construct measured by asking respondents to indicate possible warning signs, from a list. <br> - 75% (n = 157) correctly identified warning signs. <br> *Knowledge of breast screening recommendations:* <br> - Construct measured by asking respondents to choose the correct answer to a statement, from a list. <br> - 78% (n = 157) correctly identified 'every year' to be the recommended time interval. <br> *Prevalence of breast cancer training* <br> - Construct measured by asking respondents to indicate agreement with a statement. <br> - 8.0% (n = 17) reported ever receiving breast cancer training. |

[a] Discrepancy between the frequencies reported alongside the percentages, when re-calculating percentages using the frequencies and total number of nurses (n = 107) provided by the authors.

response. Scores were summed to allow the quality of studies to be compared based on the number of criteria met. Studies were also compared by ratings on individual quality assessment items.

The approach to ensure rigour in quality assessment was identical to that used for data extraction (i.e. all studies were initially assessed by HS, and 20% were checked by KW). All studies were included in the review regardless of their quality; however, conclusions described in the discussion gave less emphasis to studies identified as lacking rigour.

### 2.6. Data synthesis

As quantitative data were insufficient for a meta-analysis due to inconsistencies in the measurement of outcomes, a narrative synthesis was conducted (Popay et al., 2006). Synthesis of data on knowledge of warning signs involved calculating average percentages of correct responses to lists of warning signs.

Qualitative data were analysed using thematic synthesis (Thomas and Harden, 2008), consisting of line-by-line coding of findings; codes were then organised into descriptive themes. Due to limited qualitative data, it was not possible to categorise these descriptive themes into analytical themes as planned.

It was planned for qualitative and quantitative findings to be integrated and analysed together using a further synthesis method (Frantzen and Fetters, 2016). However, as only two qualitative studies met the inclusion criteria, the results of the quantitative data analysis became the dominant focus of the findings; results of the qualitative data analysis were woven into these findings.

## 3. Results

### 3.1. Study characteristics

A summary of the 21 included studies is presented (Table 1). The majority of studies were conducted in the United States (US) (n = 7). The remainder were from: Brazil (n = 4), Spain (n = 2), UK (n = 2), Ireland (n = 1), Turkey (n = 1), Jordan (n = 1), Saudi Arabia (n = 1), Oman (n = 1), and Australia (n = 1). The Omani study was published in two different articles (Muliira et al., 2016a, 2016b), and one Brazilian study was published in three (Hallowell et al., 2017; Perin et al., 2015; Stormo et al., 2014).

For quantitative studies, sample sizes ranged from 8 (Oliveira da Fonseca et al., 2016) to 636 (Esteban-Vasallo et al., 2017), and response rates ranged from 20% (Patel et al., 2016) to 85% (Ertem, 2009). The sample sizes of the two qualitative studies were 14 (McSherry et al., 2012) and 18 (Mills et al., 2012). Few studies reported on demographic and professional characteristics. Where they did, women predominated - representing 85% (Hallowell et al., 2017; Perin et al., 2015; Stormo et al., 2014) to 100% (McSherry et al., 2012; Patel et al., 2016; Shimpi et al., 2016; Yousuf et al., 2012) of samples. The proportion of those aged over 40 years ranged from 13% (Oliveira da Fonseca et al., 2016) to 80% (Esteban-Vasallo et al., 2017), and the proportion of those who had over 10 years of practice experience ranged from 22% (Ertem, 2009) to 81% (Yousuf et al., 2012).

Ratings of studies on each of the MMAT assessment criteria are presented on Table 2. Quantitative studies largely failed to fulfil quality criteria: one met none of the MMAT criteria (Oliveira da Fonseca et al., 2016); 14 studies met one criterion (Boone et al., 2016; Blake and Malone, 2014; De Moraes et al., 2016; De Souza Teixeira et al., 2017; Esteban-Vasallo et al., 2017; Lawvere et al., 2004; McIlfatrick et al., 2014; Muliira et al., 2016a, 2016b; Omran et al., 2015; Patel et al., 2016; Ramos et al., 2010; Shaheen et al., 2000; Shimpi et al., 2016; Yousuf et al., 2012), three met two (Cooper et al., 2014; Ertem, 2009; Meng et al., 2007), and one met three (Hallowell et al., 2017; Perin et al., 2015; Stormo et al., 2014). Common shortcomings included: use of invalidated measuring instruments; low response rates; recruitment of samples unrepresentative of the wider population (e.g. due to

**Table 2**
Ratings of studies on each of the MMAT assessment criteria.

| Author (year) | Screening questions | | Qualitative | | | | Quantitative descriptive | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | A. Are there clear qualitative and quantitative research questions, or a clear mixed-methods research questions? | B. Do the collected data address the research question? | 1.1 Are the sources of qualitative data relevant to address the research question? | 1.2 Is the process for analysing qualitative data relevant to address research question? | 1.3 Is appropriate consideration given to how findings related to the context in which data were collected? | 1.4 Is appropriate consideration given to how findings relate to researchers' influence through interaction with participants? | 4.1 Is the sampling strategy relevant to address the research question? | 4.2 Is the sample representative of the population under study? | 4.3 Are measurements appropriate (clear origin, or validity known, or standard instrument)? | 4.4 Is there an acceptable response rate (60% or above)? |
| Blake & Malone (2014) | Yes | Yes | – | – | – | – | Yes | No | No | No |
| Boone et al. (2016) | Yes | Yes | – | – | – | – | Yes | No | No | No |
| Cooper et al. (2014) | Yes | Yes | – | – | – | – | Yes | Yes | No | No |
| De Moraes et al. (2016) | Yes | Can't tell | – | – | – | – | Can't tell | No | No | Yes |
| De Souza Teixeira et al. (2017) | Yes | Yes | – | – | – | – | Can't tell | No | No | Yes |
| Ertem (2009) | Yes | Yes | – | – | – | – | Yes | No | No | Yes |
| Esteban-Vasallo et al. (2017) | Yes | Yes | – | – | – | – | Yes | No | No | Can't tell |
| (Hallowell et al., 2017; Perin et al., 2015; Stormo et al., 2014) | Yes | Yes | – | – | – | – | Yes | Yes | No | Yes |
| Lawvere et al. (2004) | Yes | Yes | – | – | – | – | Yes | No | No | No |
| McIlfatrick et al. (2014) | Yes | Yes | – | – | – | – | Yes | No | No | No |
| McSherry et al. (2012) | Yes | Yes | Yes | Yes | No | No | – | – | – | – |
| Meng et al. (2007) | Yes | Yes | – | – | – | – | Yes | No | Yes | No |
| Mills et al. (2012) | Yes | Yes | Can't tell | Can't tell | Yes | No | – | – | – | – |
| (Muliira et al., 2016a, 2016b) | Yes | Yes | – | – | – | – | Yes | No | No | Can't tell |
| Oliveira da Fonseca et al. (2016) | Can't tell | Can't tell | – | – | – | – | Can't tell | Can't tell | Can't tell | Can't tell |
| Omran et al. (2015) | Yes | Yes | – | – | – | – | Yes | No | Can't tell | Can't tell |
| Patel et al. (2016) | Yes | Yes | – | – | – | – | Yes | No | No | No |
| Ramos et al. (2010) | Yes | Yes | – | – | – | – | Yes | No | No | No |
| Shaheen et al. (2000) | Yes | Yes | – | – | – | – | Yes | No | No | Can't tell |
| Shimpi et al. (2016) | Yes | Yes | – | – | – | – | Yes | No | No | Can't tell |
| Yousuf et al. (2012) | Yes | Yes | – | – | – | – | Yes | No | No | No |

sampling from only one geographic region, or recruiting from educational meetings, or through managers of health centres); poorly described sampling methods.

Qualitative studies met no more than two of the MMAT criteria (McSherry et al., 2012; Mills et al., 2012). Study shortcomings included: sampling method being insufficiently described and lack of consideration of how researchers' epistemological stance and perspective may have influenced findings.

### 3.2. Knowledge of cancer warning signs

Three studies measured knowledge by asking respondents to indicate, from a list, possible warning signs of cancer. Findings indicate that an equally high proportion of Saudi Arabian and Turkish nurses correctly identified warning signs for breast (74.8%) and cervical cancer (77.3%), respectively (Ertem, 2009; Yousuf et al., 2012).

An US study found nurses' knowledge of warning signs to fluctuate across gynaecological cancer types investigated (cervical, ovarian, uterine, vaginal and vulva cancer). Average percentages of correctly recognised warning signs ranged from: 24.5% for vaginal cancer to 71.8% for uterine cancer (Cooper et al., 2014). Furthermore, 42.1% of US nurses correctly identified warning signs for cervical cancer (lower proportion than found in study of Turkish nurses, reported above). However, this may be explained in part by differences in instruments used to measure knowledge.

A further study measured Jordanian nurses' knowledge of colorectal cancer by asking respondents to recall four common warning signs of this cancer type (i.e. abdominal pain, blood in stool, change in bowel habits, weight loss) (Omran et al., 2015). This study found that 24.9% of Jordanian nurses could recall them correctly. However, it is unclear whether these warning signs reported in the paper were the four most commonly recalled by respondents, or those considered by the authors to be most predictive of colorectal cancer.

### 3.3. Knowledge of screening recommendations

Ten studies measured knowledge about one or more of the following cancer screening recommendations: age of initiation, age of termination, and the time interval for which screening should be conducted. Most of these studies measured knowledge (n = 6) by asking respondents to choose correct answers from a list of statements about screening recommendations. One study examined knowledge by providing respondents with vignettes of hypothetical women of different ages, and asking respondents to indicate their screening recommendations from a list of options (Boone et al., 2016). The remaining three studies did not specify how they measured knowledge of screening recommendations (De Moraes et al., 2016; Oliveira da Fonseca et al., 2016; Omran et al., 2015).

#### 3.3.1. Age of screening initiation

Seven studies measured knowledge of the recommended age of screening initiation. A finding of interest was that very few Jordanian or Brazilian nurses knew the correct recommendations in their countries. In Jordan, 9.1% of nurses knew the recommendation for colorectal screening to be '50 years' (Omran et al., 2015). In Brazil, 5.0% and 12.5% of nurses correctly identified the recommendation for breast screening to be '50 years' (De Moraes et al., 2016; Oliveira da Fonseca et al., 2016). A further Brazilian study, assessing knowledge among nurses who perform screening procedures, found that 37.0% reported correctly initiating colorectal screening among individuals 'aged 50–55 years' (Perin et al., 2015); 14.3% correctly reported initiating cervical screening among those 'aged 25 or older' (Stormo et al., 2014).

In comparison, a relatively high proportion of nurses in the US, and Oman, knew the correct recommendations in their countries. In the US, 50.0% of nurses knew the correct age of initiation for cervical screening to be '21 years' (Boone et al., 2016); 72.0% knew the recommendation

for breast screening to be '40 years' (Lawvere et al., 2004). In Oman, 62.2% of nurses correctly identified '50 years' to be the recommendation for colorectal screening (Muliira et al., 2016b).

#### 3.3.2. Age of screening termination

Three studies measured knowledge of the recommended age of screening termination. Knowledge of this recommendation was found to vary across the countries examined. Proportions of nurses, who correctly identified the recommended age of termination in their countries, were found to be higher in the US (67.0%) for cervical screening (Boone et al., 2016), and intermediate in Oman (40.2%), and lower in Jordan (5.2%), for colorectal screening (Muliira et al., 2016b; Omran et al., 2015).

#### 3.3.3. Time intervals for screening

Nine studies measured knowledge of the recommended time interval for screening. A significant finding was that a considerably low proportion of nurses in Turkey, Brazil, Jordan and Oman, knew of the correct recommendations in their countries. In Turkey, 36.1% correctly identified 'every two to three years' to be the recommendation for cervical screening (Ertem, 2009). In Brazil, 13.3% and 10.9% of nurses correctly identified 'every two years' to be the recommendation for breast screening (De Moraes et al., 2016; Hallowell et al., 2017). Two studies, assessing knowledge of recommendations for colorectal screening, found that 0.9% of Jordanian nurses, and 6.1% Omani nurses, correctly identified 'every 10 years' to be the recommendation for colonoscopy (Muliira et al., 2016b; Omran et al., 2015); 3.0% of Jordanian nurses, and 34.1% of Omani nurses, correctly identified 'every five years' to be the recommendation for flexible sigmoidoscopy, and 7.8% of Jordanian nurses, and 36.6% of Omani Nurses, correctly identified 'every year' to be the recommendation for faecal occult blood (FOB) testing.

In comparison, a generally high proportion of Saudi Arabian and UK nurses knew of the recommendations in their countries. In Saudi Arabia, 77.6% correctly identified 'every year' to be the recommendation for breast screening (Yousuf et al., 2012). In the UK, 92.6% correctly identified 'every three years' to be the recommendation for cervical screening, for women who have received negative results for both cytology and HPV testing, following treatment for abnormal cells in the cervix (Patel et al., 2016).

In the US, knowledge of recommended time intervals varied by different screening procedures and age groups. A noticeably high proportion of nurses (72.0%) correctly identified that women aged 40–49 years should have breast screening 'every one to two years'; a moderately high proportion (50.3%) correctly identified that women aged 50 years or older should have this procedure 'every year' (Lawvere et al., 2004). In contrast, among a sample of US nurses who reported to perform cervical screening, an intermediate proportion (43.0%) correctly identified that women aged 41 should have this procedure 'every three or five years'; a lower proportion (33.0%) correctly identified that women aged 26 years should have it 'every three years' (Boone et al., 2016).

### 3.4. Frequency reporting to have 'cancer early diagnosis-related discussions'

Four studies, described below, examined the proportion of nurses reporting to have 'cancer early diagnosis-related discussions' with patients, by asking respondents to indicate their agreement with statements about having such discussions. One study did not specify how this construct was measured (De Souza Teixeira et al., 2017).

A UK study found a high proportion of nurses to routinely promote cervical screening (91.6%) and provide information about its benefits (87.4%) (McIlfatrick et al., 2014). Whereas, a moderately high proportion of these nurses reported routinely promoting breast and colorectal screening (68.8%). In the US, a vast majority of nurses reported recommending colorectal screening using FOB testing (92.2%)

**Table 3**
Commonly reported barriers and facilitators to having screening discussions.

| Overarching themes | Author (year) | | |
| --- | --- | --- | --- |
| | Ramos et al. (2010) | McIlfatrick et al. (2014) | McSherry et al. (2012) |
| **Resources** | Barriers:<br>• Lack of time<br>• Involvement in other screening programmes | Barriers:<br>• Lack of time<br>• Lack of financial resources | Barriers:<br>• Not enough information available on HPV infection and testing<br>Facilitators:<br>• Having decision aids, leaflets, and guidelines available on HPV |
| **Emotion** | Barriers:<br>• Professional burnout | – | Barriers:<br>• Believing discussions about HPV infection and testing will cause themselves embarrassment |
| **Knowledge** | Barriers:<br>• Lack of knowledge about screening and colorectal cancer | – | Barriers:<br>• Lack of knowledge about HPV infection and testing |
| **Communication skills** | Barriers:<br>• Difficulty explaining information about screening to patients | – | Barriers:<br>• Difficulty initiating discussions<br>• Difficulty explaining HPV infection in a way that patients with understand<br>Facilitators:<br>• Ability to recognise opportunities to raise these topics with patients<br>• Having clear plans of what to say |
| **Beliefs about patient reaction** | Barriers:<br>• Perceiving clients to be fed up with screening tests | Barriers:<br>• Perceived lack of patient demand | Facilitators:<br>• Patients appearing open or interested |
| **Perceived consequences** | Barriers:<br>• Perceiving false positive screening results to generate anxiety<br>• Perceiving colonoscopy to be an invasive procedure | – | Barriers:<br>• Believing discussions will cause:<br>- themselves to appear judgemental<br>- patients to feel embarrassed<br>- patients to be put off attending cervical screening<br>- patients to believe their partners have been unfaithful |
| **Staff support** | – | Barriers:<br>• Lack of staff support | |

(Shaheen et al., 2000). Whilst, a smaller minority of these nurses reported recommending flexible sigmoidoscopy (69.3%).

In comparison, a markedly low proportion of nurses in Brazil, Jordan and Oman, reported having 'cancer early diagnosis-related discussions' with patients. Findings indicate that 1.7% of Jordanian nurses, and 8.5% of Omani nurses, reported recommending colorectal screening (Muliira et al., 2016a; Omran et al., 2015). Whilst, 3.5% of Jordanian nurses, and 9.8% of Omani nurses, reported providing health education on colorectal cancer. In Brazil, 4.3% reported recommending breast screening (De Souza Teixeira et al., 2017).

*3.5. Factors perceived to influence the frequency of 'cancer early diagnosis-related discussions'*

Three studies measured factors perceived by nurses to influence their discussions about cancer screening. Table 3 presents the barriers and facilitators to having such discussions that were most commonly reported. These factors fell into the following overarching themes: 'resources', 'emotion', 'knowledge', 'communication skills', 'beliefs about patient reaction', 'perceived consequences', and 'staff support'.

One Spanish study examined nurses' perceived barriers to encouraging reluctant patients to participate in colorectal screening, and to gaining primary care professionals' support of their organised screening programme (Ramos et al., 2010). Commonly posited barriers to encouraging reluctant patients to participate included: perceiving colonoscopy as invasive (65.8%), anxiety generated by false positives (48.6%), and perceiving patients to be fed up with screening tests (32.5%). Whilst, frequently perceived barriers to primary care professionals supporting the programme included: lack of time (83.9%), professional burnout (54.0%), lack of knowledge about screening (42.2%) and colorectal cancer (35.0%), involvement in other screening programmes (29.9%), and difficulty relaying information on screening to patients (29.7%).

A UK study investigated perceived barriers to promoting breast and colorectal screening, among nurses who reported not discussing these procedures with patients (McIlfatrick et al., 2014). The main barriers reported included lack of: patient demand (% not reported), staff support (% not reported), financial resources (% not reported) and time (22.7%). However, it was not specified how perceived barriers were measured.

An Irish qualitative study explored perceived barriers and facilitators to having discussions with patients about HPV infection and testing (McSherry et al., 2012). Barriers commonly discussed included: lack of knowledge about HPV; perceived difficulty in initiating discussions and explaining HPV in lay-terms; worry about causing themselves or patients embarrassment, or appearing judgemental; and concern that discussions would put patients off attending cervical screening, or convey belief that their partner had been unfaithful. Facilitators frequently mentioned included: patients appearing open or interested; decision aids, leaflets, and guidelines being available on these topics; and perceived ability to initiate discussions and formulate plans on what to say.

*3.6. Prevalence of 'cancer early diagnosis-related' training*

Seven studies measured the proportion of nurses who had received 'cancer early diagnosis-related' training. A considerably low proportion of Spanish (8.2%), US (10.0%), and Saudi Arabian nurses (8.0%) received 'cancer early diagnosis-related' training during pre-qualification education (Esteban-Vasallo et al., 2017; Shimpi et al., 2016; Yousuf et al., 2012).

A similarly low proportion of US, Omani and Jordanian nurses were found to receive post-qualification education relating to this topic. In the US, 19.0% of nurses received continuing education within the last year on skin cancer (Blake and Malone, 2014). The Omani and Jordanian studies found that 25.6% and 7.6% of nurses received continuing

education within the last three years on the prevention and screening of cancer generally (Muliira et al., 2016b; Omran et al., 2015); 5.6% of Jordanian nurses received this education on colorectal cancer specifically.

A UK study found 43.7% of nurses reporting to have received continuing education on HPV and cervical screening within the last year (Patel et al., 2016). However, a considerably high proportion of these nurses reported receiving this training at some point during their career (96.8%).

*3.7. Perceived adequacy of 'cancer early diagnosis-related' training and support*

Three studies examined nurses' perceptions of 'cancer early diagnosis-related' training by asking respondents to select from a list of options. Findings suggest that, across all countries assessed, a relatively low proportion of nurses rated training as 'adequate'. In the US, 36.1% rated training on oral cancer as 'good/very good' (Meng et al., 2007). Whilst, 32.9% of Omani nurses, and 3.1% of Jordanian nurses, rated continuing education on the prevention and screening of cancer generally as 'adequate' (Muliira et al., 2016b; Omran et al., 2015).

A UK study included a free-text component, where nurses performing cervical screening provided comments on their initial training on HPV and cervical screening and their mandatory three-yearly updates (Patel et al., 2016). Their feedback identified need for improvement citing time constraints and travel distance as barriers to attendance; they called for online training programmes and assessments with regular emails or newsletters to update.

An Australian qualitative study conducted interviews, exploring perceived facilitators to their role regarding cervical screening, and included questions on interviewees' experiences of training (Mills et al., 2012). These nurses valued their continued learning, beyond initial training on cervical screening, through the exchange of knowledge from physicians and peers. Nurses perceived the availability and accessibility of physicians' expert advice to influence their knowledge. Peer networks were seen as another opportunity to gain knowledge or seek advice following training.

## 4. Discussion

To our knowledge, this is the first systematic review to collectively examine evidence on primary care nurses' contribution to cancer early diagnosis in developed countries, and how this varies internationally. The majority of the 21 studies included in this review were from the US, with remaining studies conducted in Europe, the Middle East, and Australia.

Similar trends in international variability were found for nurses' knowledge of cancer screening recommendations, and the frequency of their 'cancer early diagnosis-related discussions' with patients. Proportions of correctly identified cancer screening recommendations, and those having 'cancer early diagnosis-related discussions', were both found to be generally higher in the US and the UK, and lower in Oman, Jordan and Brazil. This implies that differences in knowledge across these countries may have influenced the proportion of nurses having discussions. However, it is challenging to draw precise conclusions regarding international variability, due to the divergent range of cancer types assessed, and paucity of findings from certain countries regarding these two constructs.

It is also important to highlight that these findings should be considered with caution as included studies were mostly low quality. In particular, findings from Jordan and Brazil, apart from one higher quality Brazilian study (Hallowell et al., 2017; Perin et al., 2015; Stormo et al., 2014), failed to adequately specify how knowledge of screening recommendations, or the frequency having 'cancer early diagnosis-related discussions', were measured. Accordingly, the low proportion of nurses found to know of screening recommendations in

Brazil and Jordan, and to have such discussions with patients, could reflect measurement bias.

Nonetheless, it is also possible for international variability in these two constructs to be explained by deviating expectations and responsibilities of primary care nurses across different healthcare systems. Nurses' knowledge, and their ability or decision to adopt practices, such as having discussions with patients, is not solely self-directed and can be influenced by national government policy, as well as the demands and priorities of their individual workplaces (Halcomb et al., 2006, 2008; Hoare et al., 2012; May, 2013). It appeared that nurses in the UK and the US, had both higher knowledge of cancer and more frequent cancer-related discussions with patients. This is likely to reflect the well-established expanded role of primary care nurses in these countries, and their autonomous provision of healthcare services, such as clinics for chronic conditions (Donelan et al., 2013; McCarthy et al., 2012). However, little information is documented about the role and responsibilities of primary care nurses in Brazil and the Middle East, where cancer incidence rates are rising (particularly for colorectal and breast cancer) and the importance of primary care in the management cancer early diagnosis is becoming more prominent (Al-Othman et al., 2015; Schmidt et al., 2011).

For countries without organised cancer screening programmes, decisions to participate in screening are influenced by patient factors (e.g. knowledge, beliefs, finance, access to appointments) and recommendations by primary care professionals (Miles et al., 2004; Weller et al., 2009); such is the case for the US, Brazil and the Middle East (Gonçalves-Silva et al., 2010; Miles et al., 2004; Schmidt et al., 2011). It is vital, therefore, that nurses in these countries have accurate knowledge of screening recommendations for them to provide appropriate advice and education regarding this topic (Boone et al., 2016). The finding that knowledge of screening recommendations, and proportions having 'cancer early diagnosis-related discussions', was substantially lower in Brazil, Oman and Jordan, is of concern.

In comparison, the UK has organised screening programmes for breast, cervical and colorectal cancer (Dowling et al., 2010; Klabunde et al., 2015), and the majority of primary care nurses perform cervical screening (Patnick, 2000). Their greater involvement with this screening programme may explain why a considerably higher proportion of UK nurses reported to promote it, compared to breast and colorectal screening (McIlfatrick et al., 2014).

Importantly, UK nurses reported difficulty in accessing training on cervical cancer. Evidence from several developed countries (e.g. UK, Australia, New Zealand and Ireland) suggests vast variability in primary care nurses' access to continuing education on cervical screening and other topics (Hoare et al., 2012; McCarthy et al., 2012; Procter et al., 2017); their access relies on local demand for training, and on individual workplaces being willing and financially able, and having large enough workforces, to allow nurses the time to attend (Bradby and McCallum, 2015). Introducing standard educational frameworks may help mitigate the variability in training access among these countries.

Only three studies examined primary care nurses' perceived barriers and facilitators to discussing cancer screening with patients (Ramos et al., 2010; McIlfatrick et al., 2014; McSherry et al., 2012). Commonly reported barriers and facilitators fell into the following overarching themes: 'resources', 'emotion', 'knowledge', 'communication skills', 'beliefs about patients' reaction', 'perceived consequences', and 'staff support'. These overarching themes appear to map onto the domains contained within the Theoretical Domains Framework (TDF; i.e. 'environmental context and resources', 'emotion', 'knowledge', 'skills and beliefs about capabilities', and 'beliefs about consequences') (Michie et al., 2005). Accordingly, this concordance with the TDF strengthens evidence from this review on barriers and facilitators to nurses having screening discussions; it also highlights the TDF as a promising framework for future research in this area.

### 4.1. Limitations and future directions

This review has a number of limitations. It was not possible to conduct a meta-analysis due to the heterogeneous nature of the measures used, and the different cancer types assessed. This resulted in it being challenging to draw precise conclusions.

Studies were mostly of low quality. Only one study used an instrument with known psychometric properties to measure constructs studied (Meng et al., 2007). Additionally, many studies sampled from only one geographic region only, or recruited through managers of health centres, or at an educational meeting, which may have introduced selection bias. Thus, it is not clear whether constructs were accurately measured, or findings can be generalised to the wider population of nurses in the countries examined. For this reason, high-quality research is needed to understand international variability in primary care nurses' contribution to cancer early diagnosis; in particular, there is need for quantitative studies measuring constructs in a standardised way.

As only two qualitative studies met the inclusion criteria, it is also essential for more qualitative research to be conducted to gain better understanding of primary care nurses' experiences of contributing to cancer early diagnosis, and their perceived barriers and facilitators to having discussions with patients relating to this topic; such research could highlight potential modifiable health system and psychosocial factors which may need to be addressed to enhance their contribution to this field.

This review also has implications for policy and practice. Although there was limited evidence on barriers to having discussions about screening, findings suggest such barriers include: lack of time, insufficient knowledge and communication skills, and believing that patients react negatively to this topic being raised. It is imperative that nurses are adequately informed on the topic of cancer early diagnosis, and that their training programmes are easily accessible (e.g. through online updates or training), and include components on enhancing their skills and confidence in discussing sensitive topics with patients.

The importance and timeliness for further research on primary care nurses' contribution to cancer early diagnosis is reinforced by the recent introduction of the 'ten point action plan for General Practice Nursing' in the UK (NHS England, 2017). This plan aims to expand the capacity and capability of primary care nurses, and includes strategies to improve access to, and the development of, training programmes. It is vital that such strategies are informed by evidence on the training needs of nurses regarding cancer early diagnosis.

## 5. Conclusion

Primary care nurses' knowledge of cancer screening recommendations, and frequency of 'cancer early diagnosis-related discussions' with patients, was found to vary internationally. However, this may be due partly to measurement bias, and divergent responsibilities of nurses across different health systems. Nurses perceived lack of time and knowledge, and their beliefs that patients react negatively to sensitive topics being raised, to be barriers to having screening discussions. They reported difficulty with providing screening information to patients in lay-terms, and identifying opportunities to initiate discussions. Further high-quality research is needed to understand nurses' contribution to cancer early diagnosis within primary care, and to develop and evaluate optimal methods for preparing them for, and supporting them in, this.

## Funding

## Declarations of interest

None declared.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ejon.2019.06.007.

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